

Water Use Efficiency Program
Proposal Solicitation Package

January 2, 2001

1. Specify: **Urban Project**
2. Proposal title: **Efficient Landscape Water Program**
3. Principal applicant: **Irrigation Training and Research Center
Cal Poly San Luis Obispo Foundation**
4. Contact: **Robert Walker, Project Director**
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9. Funds requested dollar amount: **\$942,639**
10. Applicant cost share funds pledged dollar amount: Work in progress **\$80,000**
11. Duration (month/year to month/year): **July 1, 2001 to June 30, 2003**
12. State Assembly and Senate districts and Congressional district(s) where the project is to be conducted: **Program Applies to the State of California**
13. Location and geographic boundaries of the project: **State of California**
14. Name and signature of official representing applicant.

By signing below, the applicant declares the following: the truthfulness of all representations in the proposal; the individual signing the form is authorized to submit the application on behalf of the applicant; the applicant will comply with contract terms and conditions identified in Section 11 of this PSP.

(printed name of applicant)

(date)

(signature of applicant)

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B. Scope of Work

♦ Abstract (Executive Summary)

The Project: The Irrigation Training and Research Center (ITRC) developed a Landscape Water Management (LWM) Program for the State of California from 1985-1991 that is acknowledged as a standard for Landscape Water Budgeting and Irrigation Scheduling throughout the United States. Using the LWM Program to develop meaningful irrigation schedules saves water and electrical energy and reduces peak electrical load. These savings were documented in a 1991 study. Measurable Electrical Load and Energy Reduction (Peak Season) can be documented with this project because urban landscapes use pressurized and treated water. **This Project will update and upgrade the existing LWM Program.** The existing LWM Program consists of:

- **Manuals** that explain the technical principles at work in Landscape Water Budgets and describe practical field evaluation procedures. The LWM Program was developed before today's BMP5 (Large Landscape Conservation Programs and Incentives) was created and does not directly support the requirements of BMP5.
- **Presentation Materials** to train green industry (landscape) staff. Due to cost constraints ITRC can conduct only 4 to 6 workshops per year, limiting the impact of the LWM Program.
- **Computer Software** to evaluate irrigation system performance data and prepare landscape water budgets and irrigation schedules. However, because it was developed over 10 years ago, the current LWM software is not:
 - Windows®-based
 - Y2K compliant
 - Network compatible

The Methods: The Irrigation Training and Research Center at Cal Poly San Luis Obispo will direct its own staff and retain consultants and programmers.

The Objectives: Update and upgrade the very successful Landscape Water Management (LWM) Program creating the **Landscape Water Efficiency Program (LWEP)** and increase its utilization by professionals, water utilities, and the green industries.

- A. **Produce State-of-the-Art Internet-Ready Program** to empower water utility staff, green industry staff, and property managers to better manage irrigation water for commercial properties throughout California. Interested homeowners will also find this program of value. The arrival of the internet now creates tremendous opportunities for real time weather data updates, multi-user data sharing, and remote learning.
- B. **Produce Updated Training Modules** that combine an updated **handbook** and **workshop presentation materials** into internet-ready files accessible to thousands of landscape professionals and millions of homeowners with practical, hands-on information about the art and science of landscape irrigation and water budgets. College instructors and vocational school teachers will also use these modules for classroom training.
- C. **Facilitate the Implementation of Best Management Practice #5** (Large Landscape Conservation Programs and Incentives) by hundreds of California water retailers and wholesalers. The internet basis of the proposed new Landscape Water Efficiency Program will provide customers with real-time water budget and irrigation schedule updates to help water utilities meet the requirements of BMP5.

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◆ Statement of Critical Issues

- **Demands on the Bay Delta can be reduced with implementation of this Landscape Water Efficiency Program (LWEP).** LWEP is particularly important for the Bay Delta because two-thirds of California's population gets some portion of their water supply by way of the Bay Delta¹. Approximately 75% of landscape water use occurs during the Summer and Fall seasons when minimum streamflow requirements are most critical.
- **The LWEP accelerates and increases implementation of BMP5.** The CALFED Record of Decision (ROD) includes Best Management Practice #5 -- Large Landscape Conservation Programs and Incentives. Fully implemented, BMP5 could permanently reduce total urban water use by as much as 3%². Hundreds of California's water retailers and wholesalers are rushing to implement the newest member of the BMPs, Large Landscape Water Budgets and Surveys (a component of BMP5). LWEP will provide these agencies with a real-time, low cost water budget and irrigation scheduling to help them meet the requirements of BMP5.
- LWEP can be used to provide access to water budget information for commercial, industrial, and institutional customers, and could substitute for the expensive mailed notices suggested by BMP5 for each billing period. LWEP can also facilitate the Irrigation Survey component of BMP5 by reporting the results of surveys directly to the customer over the internet.
- **LWEP provides an important Drought Response Capability for water purveyors.** Working with the California Department of Water Resources during the drought of 1987-91, the ITRC demonstrated that Landscape Water Management training and software can help landscape managers and homeowners identify irrigation deficiencies, estimate potential savings and implement step-by-step solutions³.
- **LWEP provides training to bring green industry staff up the learning curve for "Water Use Efficiency" much faster.** Good irrigation water management (urban or agricultural) is science based and requires knowledge to do a good job; field staff must understand irrigation system performance, soils, plant water needs, and weather data. Without training, knowledge must be obtained by trial and error. Knowledge obtained from LWEP training, California can save more urban water and save it sooner.
- **Traditional training approach limits access of the green industry.** Efforts to train green industry professionals using the current LWM program have historically been limited to 4 to 6 workshops a year, reaching at best only 120 to 150 people. This is far too small a number to have any hope of accomplishing significant water savings. In fact, this is a probable net loss of trained people, considering retirement, promotions, and changes in careers among the California Green Industry workers.

¹ Water Issues, Water Education Foundation, <http://www.water-ed.org/california.asp#waterissues>.

² Dr. John Whitcomb, (Stratus Consulting) estimates a potential urban sector savings from landscape water budgets of as much as 10%, CII Conference, January 2001, Fresno CA.

³ Evaluation of Energy and Water Savings for North Marin Water District, NEOS Corporation, Contract #DE-AC6586WA00497, Dec. 1991.

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- **In addition to BMP5, this project supports BMPs 1, 4, 7, 8, 9, 11 and 13 by addressing the needs of water wholesalers, retailers and customers, the green industry, the green waste and pest control industries, and all levels of the education sector.**

In addition to direct support of BMP5, LWEP indirectly supports many other BMPs, as illustrated below.

BMP	Description	Rationale
1	Water Survey Programs For Single Family Residential And Multifamily Residential Customers	Addresses outdoor component of MFR dwellings and supports interested homeowners
4	Metering With Commodity Rates For All New Connections And Retrofit Of Existing Connections	Retrofit of dedicated irrigation meters facilitated with landscape water budgets
7	Public Information Programs	LWEP Web site provide Landscape Water and Energy Efficiency information
8	School Education Programs	LWEP Training modules available over the internet for use in schools
9	Conservation Programs For Commercial, Industrial, And Institutional (CII) Accounts	Addresses outdoor component of CII facilities
11	Conservation Pricing	Landscape Water Budgets facilitate conservation pricing by guiding end users to apply the proper amount of water
13	Water Waste Prohibition	Good landscape water management reduces "gutter flooding" -- irrigation water runoff and overspray

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◆ Nature, scope, and objectives of the project.

Work in Progress

Currently the ITRC is working on behalf of the U.S. Bureau of Reclamation, Mid-Pacific Region, to define future efforts to update the existing Landscape Water Management Program. An industry survey is underway to define technical issues from a variety of user perspectives. This effort will conclude with a program design that will define the program update using the perspective gained from the industry survey.

Work Being Proposed

- **Program Development** will extend the current work in progress and will focus on updating and simplifying technical materials while significantly expanding the access of Green Industry professionals to the tools provided by the LWM program. The entire project proposed here takes place over a three-year period. The five stages of work are: 1) Initial Development; 2) Testing; 3) Initial Modification; 4) Final Evaluation & Modification; and 5) Continuing Support.

1. **Initial Development.** With the advent of BMP5, the green industry is being asked to focus on Water Budgets. The LWEP will develop a reference handbook and training modules covering the basic principles of landscape water budgets and practical techniques for managing landscape water budgets.

The reference handbook will employ the PDF (Acrobat Reader) format, which permits a hypertext Table of Contents and one-click access to additional web-based information.

While the existing LWM handbooks will be used as a starting point, the new handbook will reflect enhanced formatting and the convenience of a single document. Additional use of sample calculations and pictures will be made with delivery to users on CD-ROM or over the internet.

The **training modules** will draw on the resources of the reference handbook and be available both in PowerPoint and in PDF format. By providing the reference handbook and training modules as internet-ready files, they will be accessible to thousands of landscape professionals and millions of homeowners. University and community college instructors and vocational high school teachers will also be able to use these modules. Used in self-paced mode over the internet, these modules will provide practical, hands-on information about the art and science of landscape irrigation. Periodic on-line skills testing will help the student gain confidence in the materials and the LWEP servers can be used to provide "bulletin board" notice of local activities of interest to landscape water managers.

The new training modules will:

- Provide updated information and data for basic principles of landscape irrigation, landscape water budgeting and irrigation system design, diagnosis and repair.
- Address the water budget, irrigation survey, system tune-up, irrigation scheduling and irrigation design review components of the software.
- Provide "portable" training modules and instruction manuals to be used by community colleges and vocational high school programs throughout California.

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Development of new science-based **curricula** for vocational high school and community colleges will begin when these initial resources are formulated. These will be customized for each level based on interactions with Vo-Ag and community college instructors.

Software Programming will begin in earnest with the reference handbook and training modules formulated. The LWEP will use the internet as a storehouse of Water Use Efficiency information, as an online Training system and as a calculation and data storage software tool.

Objectives include being Windows-compatible and web-aware with an embedded Help system and examples. Two modes adapted to user expertise are anticipated, for example "Basic" and "Pro".

Tracking landscape water use and calculating appropriate irrigation schedules benefit greatly from the use of computers. To really improve water use efficiency in the urban landscape sector, software must be easy to use, comprehensive, and produce output that can be easily applied to water budget tracking and irrigation scheduling. The current LWM software (Version 1.4) is out of date (not Y2K compliant, does not print over networks, uses nomenclature from AB325, not BMP5) and does not facilitate multi-user sharing of data and action items.

Consider that commercial landscapes are inherently multi-user -- a single site has:

- a water retailer
- an owner
- a property manager
- a landscape contractor (with both area managers and team leaders)
- an irrigation surveyor from the water district
- commercial tenants or condominiums owners

Each of these entities has an interest in tracking landscape water use and verifying that needed tasks are being carried out on time.

The promise of LWEP is that it will allow all of these parties to track real-time water use and budgets and (with password authority) to edit or add information to the site's records. CIMIS weather data will be automatically available for calculations and comparative data can be viewed to help "benchmark" the site's performance against other similar sites in that zip code.

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The new software will:

- Compute ET_o -based water allowance and target budget for efficient irrigation of landscapes in the urban environment.
 - Evaluate existing landscapes and irrigation systems to determine if they can stay within the water allowance.
 - Provide system tune-up checklists to bring existing systems into compliance with the water allowance.
 - Generate irrigation schedules and maintenance checklists for turf and landscape based on the existing (or planned) irrigation system and plant materials.
 - Provide evaluation of new landscape and irrigation systems designs or renovation of existing systems.
 - Incorporate the advantages of the internet wherever possible. internet access will be provided for all LWEP components, including downloadable forms of the reference handbooks, training modules and software. Real time access to weather data and plant material landscape coefficients is also planned. In the near future access may be expanded to support handheld devices being used in the field to record inspection and field test data and to send schedule programming information directly to field staff as they reprogram irrigation controllers.
2. Testing. All of the materials developed in Step 1 above will be tested with public workshops, actual instruction at the Vo-Ag and community college level, and with internet activity using a project web server for access to LWEP software and additional materials. Comments and suggestions will be tabulated noting the nature of the observation as well as the source of the comment.
 3. Initial Modification. Using the test results, modification of the reference handbook, modules, curricula, and LWEP software will be performed. Continuing review by ITRC staff and the project manager will be made to ensure that any changes are properly integrated into the Landscape Water Efficiency Program.
 4. Final Evaluation & Modification. Evaluation will be made at this stage to ensure that the LWEP has reached its objectives.
 5. Continuing Support. After final evaluation and modification, support will be provided for LWEP through the end of the contract period. Additional suggestions and modifications based on more extensive deployment of the handbook, training modules, curricula and software are anticipated.

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Methods, Procedures, and Facilities.

Starting about 12 years ago, Cal Poly ITRC began work with Calif. DWR to develop turf/landscape irrigation management training tools. An initial manual approach to water auditing and water conservation training was developed. Subsequently, putting many of the computations and learning steps into software that could be run on laptop computers enhanced the training. The training was a great success, and was received by about 1000 persons who ranged from park managers to irrigation supervisors to water conservation coordinators from water agencies.

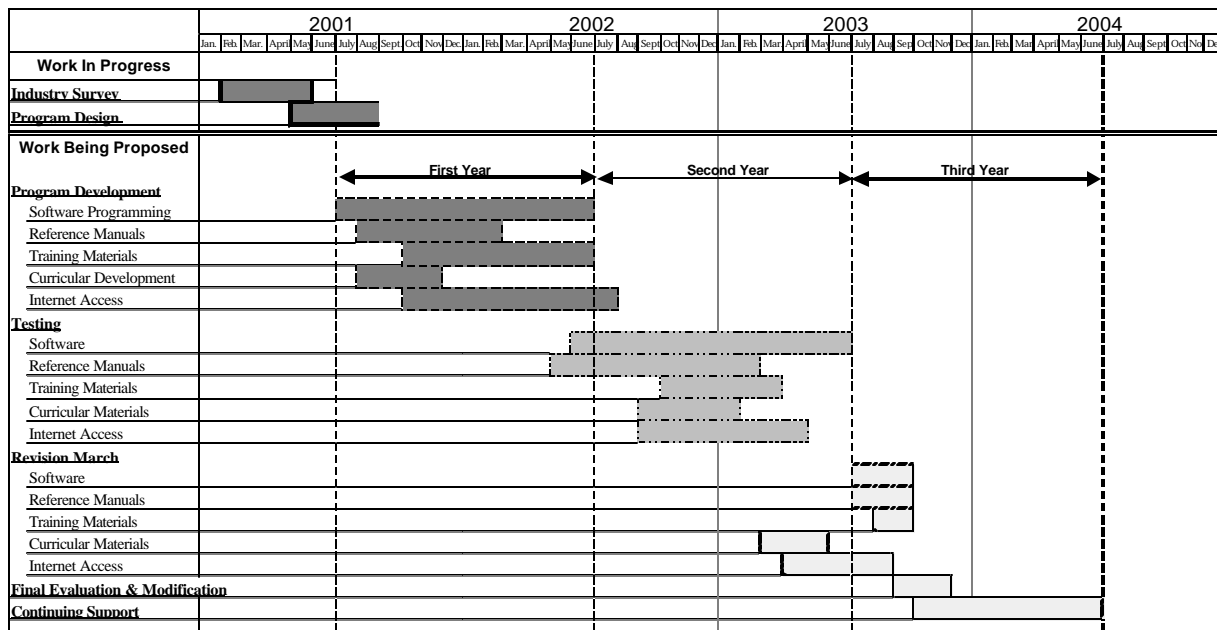
In the early 1990s, funding was received from DWR and Metropolitan Water District of Southern California to upgrade the training, concepts, and software. This upgrading incorporated many of the suggestions from prior trainees, various water agencies, irrigation equipment manufacturers, and others that have been involved with LWM in some way. In response to AB325 and the Model Efficient Landscape Ordinance, the program was expanded to include the concepts of water budgeting, in addition to the earlier modules that dealt with water auditing and irrigation scheduling.

Since then, an additional nearly 3,100 persons have received training. The training materials are also recognized for their value in that they are the basis for landscape water conservation training by The Irrigation Association throughout the U.S.

Since the early 1990s, there has been a tremendous increase in sophistication in the understanding of landscape water management needs and constraints. ITRC has continued to make minor changes to the software and training and manuals in response to suggestions. But at this point in time, the software needs the major overhaul that will be provided by this project.

There are examples throughout California of innovative site managers employing "modern" landscape management procedures (including "multi-user" partnerships with property managers and landscape contractors) and we will survey their accomplishments to ensure that their needs are addressed. This will clear a path for others to follow.

◆ Schedule



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◆ **Monitoring and Assessment**

ITRC knows that over three thousand people have received Landscape Water Management training over the years. But there is no easy way of knowing how many landscape sites have actually received evaluations, irrigation schedules or water budgets using the LWM materials. An internet-based approach for software and weather data distribution provides a powerful means to document the use of the new materials developed through this project.

By using a centralized "Landscape Irrigation Data Server" strategy, it will be possible to provide users with automatic updates of weather information and their site water budgets as well as to provide them with comparative assessments of their system inspection scores and tested performance.

For example, a property manager using the new software could create a new site record, complete a basic survey using drop down menus and embark on a process that will provide an "inspection score", tune-up checklists, and sample irrigation schedules for the site. At the request of the property manager, the landscape contractor can also interact with the same site record, initially providing landscape area data and eventually entering weekly water meter readings. The result would be an up-to-date chart comparing actual irrigation water used to a target budget for the site, available for viewing by both the property manager and the landscape contractor.

Because all site records would be hosted centrally, ITRC, DWR and funding agencies can receive an overview of user participation⁴ at any time, showing total number of users, frequency of LWM software use and cumulative statistics about potential and actual water savings. The following data, for example, could be summarized by zip code:

- Inspection quality and improvements with time
- Overall water use amounts and changes in water use
- Requests by users for Assistance and Training.

C. Outreach, Community Involvement, and Information Transfer

◆ **Describe outreach efforts**

By its nature this project provides opportunities to all persons working in the landscape sector. Training materials provided over the internet to community colleges and vocational high schools, landscape maintenance contractors, and other professional groups will make these educational materials available to thousands of people that would otherwise not have access.

There are over 200 community colleges and 500 vocational high school programs in California; many of these programs are already providing the fundamental training for a portion of the landscape workforce. The potential market for these state-of-the-art training materials seems to be very significant. The idea is to develop material that is appropriate for the grade level and supports the BMP and urban water conservation objectives, and make them available to as large a portion of the work force as possible.

⁴ In the interests of privacy, it is proposed that individual site records not be publicly accessible other than by a retailer who automatically provides billing data to the system as an aid to end-users.

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Web-based materials make it relatively simple to monitor the amount of use by various groups, students, teachers, and professionals.

◆ Information Dissemination

The potential for widespread dissemination of project results is embodied in the internet-based approach. There is also potential "extranet" benefits in the form of community college instructors and vocational teacher tapping directly into the web servers of this project to present materials to their students and provide "distance learning" course outlines, downloadable exercises and online quizzes and grading. Water utilities, libraries and community colleges can provide internet-connected computers for use by landscape customers that may not have full internet access. Participation by residential irrigators is also possible and the site's keywords will be distributed to web search engines to ensure that individuals interested in "landscape water management" will find the new LWM website.

1. Notification Letter

The ITRC is presently conducting a statewide survey of interest and needs for this project. This will also serve to alert agencies throughout the state of the software improvement project. We also expect coverage in DWR's Water Conservation News as the project proceeds. The request for responses and the questionnaire are in the appendix. This request has been sent to over 3,100 past attendees of the Landscape Water Auditor and Budgeting class, and some 300 Certified Landscape Irrigation Auditors (Irrigation Association CLIA program).

D. Qualifications of the Applicants, Cooperators, and Establishment of Partnerships

◆ Resumes

The resume of the Project Manager, Professor Robert Walker, is attached. Professor Walker will manage the staff of the ITRC and external cooperators to ensure the timely accomplishment of project objectives.

◆ External Cooperators

To provide continuity with the original team that developed the Landscape Water Manager software in 1989-91, Gary Kah will be retained as a subcontractor (resume attached). When CALFED has approved the project objectives, a software design and programming firm will be hired.

◆ Partnerships

ITRC has established a unique reputation as a center of excellence for irrigation technology and training. But this project requires delivery of a software capability to thousands of end-users throughout the State. To ensure the feasibility of this project, the ITRC will cultivate professional groups working in the green industry such as: California Landscape Contractor's Association (CLCA); Building Owners and Managers Association (BOMA); Golf Course Superintendents Association; The Irrigation Association; university, community colleges, and Vo-Ag high school programs with urban landscape components. Representatives from these groups will be consulted for input to increase the usability of the Landscape Water Efficiency Program.

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E. Costs and Benefits

1. Budget summary and breakdown. 1. Budget breakdown.

Item	Total	First Yr	Second Yr	Third Yr.
a. Salaries And Wages	290,021	115,451	92,394	82,177
b. Fringe Benefits	37,671	13,818	11,991	11,861
c. Supplies	9,500	4,300	3,135	2,065
d. Computer Usage	21,939	7,800	7,240	6,899
e. Consultants	432,000	285,600	85,650	60,750
f. Travel	15,220	7,610	4,200	3,410
g. Other Direct Costs*	136,288	53,898	43,391	38,999
h. Total Estimated Costs	\$ 942,639	\$ 488,477	\$ 248,001	\$ 206,161

***Direct Cost plus 35% Modified Total Direct Costs
(excluding student stipends, equipment, or subcontracts over \$25,000)**

2. Budget Justification

Salaries and overhead used to develop the cost estimate for this proposal are based on previous contracts between the Cal Poly Foundation and U.S. Bureau of Reclamation (a Federal Agency) and the California Department of Water Resources.

Cost sharing has historically come from agencies supporting workshops, distribution of training materials, and on going technical support. Example have been:

1990 - As part of their drought response DWR fully funded 50 workshops in a single year.

1994 – MWD of Southern California funded a major upgrade of the LWM program.

3. Benefit Summary

The improvement and continuation of the Landscape Water Management Program will provide the green industry with the best tools and training possible to save water, energy and reduce the peak demand for electricity.

How much landscape water can be saved? Estimates of savings range from 1.8% to 3% of the total water used by the urban sector. Metropolitan Water District of Southern California⁵ estimates that their landscape water conservation programs will save from 1.8 % in 2010 to 2% in the year 2020 of the total Urban Water demand. In a 1991 evaluation of irrigation auditing for the North Marin Water District⁶ (NMWD) it was concluded that Irrigation System Auditing and Scheduling could save 3% of the water delivered by NMWD. ITRC concludes that the potential savings of urban landscape water on a statewide is likely to be approximately 1%.

⁵ University of California, Riverside Turfgrass Research Program, UCRTTRAC Newsletter, August 1999.

⁶ Evaluation of Energy and Water Savings for North Marin Water District, NEOS Corporation, Contract #DE-AC6586WA00497, Dec 1991

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Using the Department of Water Resources⁷ estimates of urban water use for the years 2010 and 2020, landscape water saved could reach 114,000 ac-ft to 127,000 ac-ft per year respectively.

The value of these water savings depends on the value of an acre-foot of water. The value of water (without energy costs) can be as low as \$10 per acre-foot or as much as \$100 per acre-foot or more, depending on the location within California. Therefore at \$10 per ac-ft the value of the potential savings range from \$1,140,000/yr in the year 2010 to \$1,270,000/yr in the year 2020.

Of course nearly all urban water must be pumped at some point along its path to end users. The amount of pumping or energy used will vary significantly between water suppliers, across the state and even within a supplier's service area.

If water is saved and not used there will be a reduction in electrical energy used. The table below shows the cost of pumping one acre-foot of water to pressures of 50,75 and 100 pounds per square inch. The cost of pumping are computed using an estimated pumping plant efficiency of 65% and for energy costs ranging from \$0.05 to \$0.15 per kilowatt-hour. If the estimated volume of landscape water savings is rounded to 100,000 ac-ft per year the value of reduced pumping ranges from \$ 909,000 per year to \$5,453,000 per year depending on the amount of energy required and the cost of energy.

E n e r g y S a v i n g s			
One Acre-Foot Water Savings			
Energy Cost	50 psi	75 psi	100 psi
\$0.05/KWH	\$9.09	\$13.63	\$18.18
\$0.08/KWH	\$13.63	\$20.45	\$27.27
\$0.10/KWH	\$18.18	\$27.27	\$36.36
\$0.15/KWH	\$27.27	\$40.90	\$54.53

Reducing the amount of pumping during peak use periods of the summer month may also reduce the peak load placed on the electric supply system. The table below shows estimates of kilo-watt demand based on the pressure required (50 to 100 psi), pumping plant efficiency (65%), a 30 day month, and 12-hours of operation a day.

D e m a n d R e d u c t i o n			
One Acre-Foot of Water Savings During Peak Months			
	Estimated Pumped Pressure (psi)		
	50 psi	75 psi	100 psi
Demand Reduction	0.5 KW	0.8 KW	1.0 KW

It is conservatively estimated that 30% of the savings occurs during the peak months of July, August and September. Using the values from the Demand Reduction table the total demand reduction could range from 5,000-10,000 kW (5-10 Megawatts).

⁷ California Water Plan Executive Summary, Bulletin 160-93, California Department of Water Resources, Table ES-6, pg 5, October 1994.